

XXXV.—On a new Genus and some new Species of Graptolites from the Skiddaw Slates. By H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

[Plate VII.]

IN the following communication I wish to draw attention to some remarkable Graptolites collected by Mr. W. K. Dover from the Skiddaw Slates, and placed by him in my hands for examination. One of these is the type of a new and very singular genus; another is a large and fine new species of the genus *Thamnograptus*; and the third is a new species of *Didymograptus*.

Genus AZYGOGRAPTUS, Nich. & Lapw.*

Polypary simple, unilateral, consisting of a single monoprioidian stipe, which is developed from the central portion of the sicula on one side. Cellules slightly overlapping.

This genus completely fills up the great break between the unilateral and bilateral siculate Graptolites, and seems to be intermediate in its characters between the true *Monograptidae* and the family of the *Nemagraptidae*. It agrees with the former in the fact that the polypary consists of a single unicellular stipe—but differs altogether in its mode of development, the celluliferous stipe springing directly from one side of the sicula about its centre. In this important character the genus agrees with no other known Graptolites than *Nemagraptus*, Emmons, and *Cænograptus*, Hall, both of these, however, including bilaterally developed forms. The cellules of *Azygograptus* are essentially of the type of *Monograptus Nilssoni*, Barr., and thus link the genus indifferently to either the *Monograptidae* or the *Nemagraptidae*.

Subjoined is a description of the only known species of the genus.

1. *Azygograptus Lapworthi*, Nich. Pl. VII. figs. 2-2c.

Polypary simple, of a single slender monoprioidian stipe, which takes origin from the centre of one side of a strongly marked pointed "sicula." The length of the sicula is about

* I have associated Mr. Lapworth with myself in the description of this new genus, partly because its name was suggested by him, and partly because it would not have been possible for me to satisfactorily determine its position and affinities had it not been for his valuable and elaborate researches on the development and classification of the Graptolites ("An Improved Classification of the Rhabdophora," Geol. Mag. vol. x. 1873).

half a line; and its shape is the normal triangular one. As there is good evidence amongst the *Diplograptidae* that the broader end of the sicula forms the proximal extremity of the polypary, I have figured the present form in a corresponding position (figs. 2 *a*, 2 *b*). The stipe is narrow, apparently from one inch to two inches in length, and about one thirtieth of an inch in width opposite to the cell-mouths. The cellules are long and narrow, resembling those of *Monograptus Nilssonii* in shape, remote (about twenty in the space of an inch), slightly overlapping, the cell-mouths being nearly at right angles to the axis.

Owing to the remarkable appearance presented by the sicula standing nearly at right angles to the celluliferous stipe, there is not any difficulty in recognizing all fragments of this species in which the base is preserved. Owing also to the marked manner in which the stipe originates from the centre of the sicula, there is no difficulty in determining that we have not to deal with a *Didymograptus* broken off at the sicula.

I have named the species in honour of my friend Mr. Charles Lapworth, whose researches have of late years so materially increased our knowledge of the structure of the *Graptolitidae*. The specimens from which the above description is taken were kindly placed in my hands for examination by Mr. W. K. Dover, who has long been an enthusiastic collector in the Skiddaw Slates. They include the remains of a great number of well-preserved individuals, none of which exhibits any branching, though the stipes are often so thickly crowded together as to render this point very difficult of observation.

Locality and Formation.—Hodgson-How Quarry, near Portinscale, Lower Skiddaw Slates. Apparently by no means of rare occurrence.

Genus THAMNOGRAPTUS, Hall.

Polypary composed of a central rachis or stem, giving off slender alternating branchlets. Cellules unknown. A dorsal "axis" (?) entering into the branchlets as well as the main stem.

Much has yet to be learnt before we can speak positively as to the nature and affinities of *Thamnograptus*, though I think there can be little doubt as to its belonging to one great group with the true Graptolites. There is a possibility that the branchlets are greatly elongated cellules; but it is more probable that the branchlets carried the cellules in a single row on one face, though at present the published evidence on this subject is insufficient to establish this view.

2. *Thamnograptus Doveri*, Nich. Pl. VII. fig. 1.

Polypary composed of a central undulating stem, about one twelfth of an inch in width, giving off alternately placed branchlets on the two sides. The branchlets are straight, about one twenty-fourth of an inch in width, and placed at intervals of from one quarter to half an inch apart (measuring on the same side of the rachis). The terminations of the branchlets are not shown; but the longest ones preserved are about an inch and a quarter in length, and show no sign of an ending. No "solid axis" can be made out; but portions of the branchlets show very distinct transverse markings, which have every appearance of being the mouths of cellules.

Thamnograptus Doveri is readily distinguished from *T. typus*, Hall, and *T. Anna*, Hall, by its much larger dimensions and the remoteness and great length of the branchlets. The only specimen known is a very well-preserved fragment about two and a quarter inches in length, and exhibiting portions of five branchlets on the one side and of six upon the other.

I have named the species in honour of Mr. W. K. Dover, by whom it was discovered.

Locality and Formation.—Randal Crag, Skiddaw. Lower Skiddaw Slates.

3. *Didymograptus gibberulus*, Nich. Pl. VII. figs. 3-3 b.

Polypary bilateral, composed of two broad monopronidian stipes, which bend backwards from the sicula in gentle curves at an angle of from 335° to 340° . The branches attain their greatest width at their junction with one another and the sicula, where they have a breadth of a line or more. The two central cellules are vertical in position; and from the vertical line thus formed the cellules become more and more obliquely divergent till they come to form an angle of about 45° with the back of the stipe. The cellules are about forty in the space of one inch; and their mouths, in well-preserved examples, are furnished with very prominent mucronate tips.

Didymograptus gibberulus belongs to the "reflexed" group of the *Didymograpti*, and is very similar in general appearance to the fossil described and figured by Mr. Salter under the name of *D. caduceus*. The original specimen on which this species was founded (Quart. Journ. Geol. Soc. vol. ix. p. 87), however, is beyond doubt an example of *Tetragraptus bryonoides*, Hall, or *T. Bigsbyi*, Hall, in which two of the normal four stipes are concealed from view by the matrix.

D. caduceus cannot, therefore, be retained, though I have little doubt that one of the forms subsequently figured by Mr. Salter from the Skiddaw States under this name (Quart. Journ. Geol. Soc. vol. xix. fig. 13 a) is identical with the species now under consideration.

That *Didymograptus gibberulus* is quite distinct from those specimens which consist of two of the stipes of *T. bryonoides* separated by the matrix from the other two, is at once seen by a comparison of the cellules near the sicula in the two cases. In *T. bryonoides* (as in all the *Didymograpti* except the present species) the primary cellules are comparatively small, the cellules not attaining their full development, or the stipes their full width, till we have receded to some distance from the sicula. There is thus a more or less extensive space opposite the sicula, which is formed by the union of the bases of the first pair of cellules and is narrower than the rest of the polypary (Pl. VII. fig. 5). On the other hand, in *D. gibberulus* the primary cellules are the most fully developed, and the stipes are consequently broader in the neighbourhood of the sicula than anywhere else (Pl. VII. figs. 3, 3 a).

There is also the very striking and unique peculiarity in *D. gibberulus* that the two primary cellules do not diverge at an angle from the top of the sicula, as is usual amongst the *Didymograpti*, but are placed vertically, parallel with the long axis of the sicula, and thus serve to divide the frond into two halves (Pl. VII. fig. 3 a).

None of the specimens that I have seen exhibits the terminations of the branches satisfactorily, the stipes in the largest of them being about nine lines long. The sicula is generally a broad blunt process, of a triangular shape, and about half a line in length; but it has occasionally a delicate thread-like extension which raises its length to two lines (Pl. VII. fig. 3 b).

In accordance with what we now know to be the true position of the sicula and its relation to the development of the celluliferous stipes, I have figured the specimens of this species in what would, prior to Mr. Lapworth's researches on this point, have been regarded as the reverse of their natural situation—namely, with the broader end of the sicula pointing downwards.

Locality and Formation.—Randal Crag and White Houses, Skiddaw, Lower Skiddaw Slates. Collected by Mr. W. K. Dover.

EXPLANATION OF PLATE VII.

- Fig. 1. *Thammograptus Doveri*, Nich., of the natural size.
 Fig. 2. A slab with numerous individuals of *Azygograptus Lapworthi*, Nich., of the natural size. 2 a. A large individual of the same, magnified two diameters. 2 b. Small portion of the base of the same, enlarged still further. 2 c. A few cellules of the same, greatly enlarged.
 Fig. 3. *Didymograptus gibberulus*, Nich., of the natural size. 3 a. Base of another specimen of the same, greatly enlarged. 3 b. Base of another example of the same, with a spiniform extension of the sicula, greatly enlarged.
 Fig. 4. A specimen of *Tetragraptus bryonoides*, Hall, in which only two of the four normal stipes are preserved. The two missing stipes, not being in the same plane, are shown in outline.
 Fig. 5. Base of two of the stipes of *Tetragraptus bryonoides*, introduced for comparison with the base of *Didymograptus gibberulus*, greatly enlarged.

XXXVI.—*On the Structure of Amphicentrum granulosum*, Huxley. By RAMSAY H. TRAQUAIR, M.D., F.G.S., Keeper of the Natural-History Collections in the Edinburgh Museum of Science and Art.

[Plate IX.]

SINCE *Amphicentrum granulosum*, Huxley, was first described by Professor Young of Glasgow*, a second species, *A. striatum*, has been recognized from the Northumberland coal-field by Messrs. Hancock and Atthey†. Regarding the structural peculiarities, however, of this most singular genus of Carboniferous fishes, there has been nothing further published than what is contained in Dr. Young's well-known paper "On the affinities of *Platysomus* and allied genera."

In a subject beset with such difficulties as the osteology of fossil fishes, where the remains are, for the most part, either crushed or fragmentary, it is natural that the advent of fresh material should not only add to our knowledge but also reveal errors in the descriptions of previous writers. And with regard to *Amphicentrum granulosum*, the careful study of a beautiful series of specimens from the North-Staffordshire coal-field, recently lent me by my friend Mr. Ward, of Longton, has led me to results which, in some important points, differ

* Quart. Journ. Geol. Soc. vol. xxii. (1866), p. 306 *et seq.*

† Ann. & Mag. Nat. Hist. ser. 4, 1872, vol. ix. p. 255.